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 **Latest release**

# Employment in Renewable Energy Activities, Australia

Employment in renewable energy activities reports on full time equivalent employment by state and territory and type of renewable energy

Reference period 2018-19 financial year

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## Main findings

This publication presents estimates of direct full-time equivalent (FTE) employment in renewable energy activities in Australia, from 2009-10 to 2018-19.

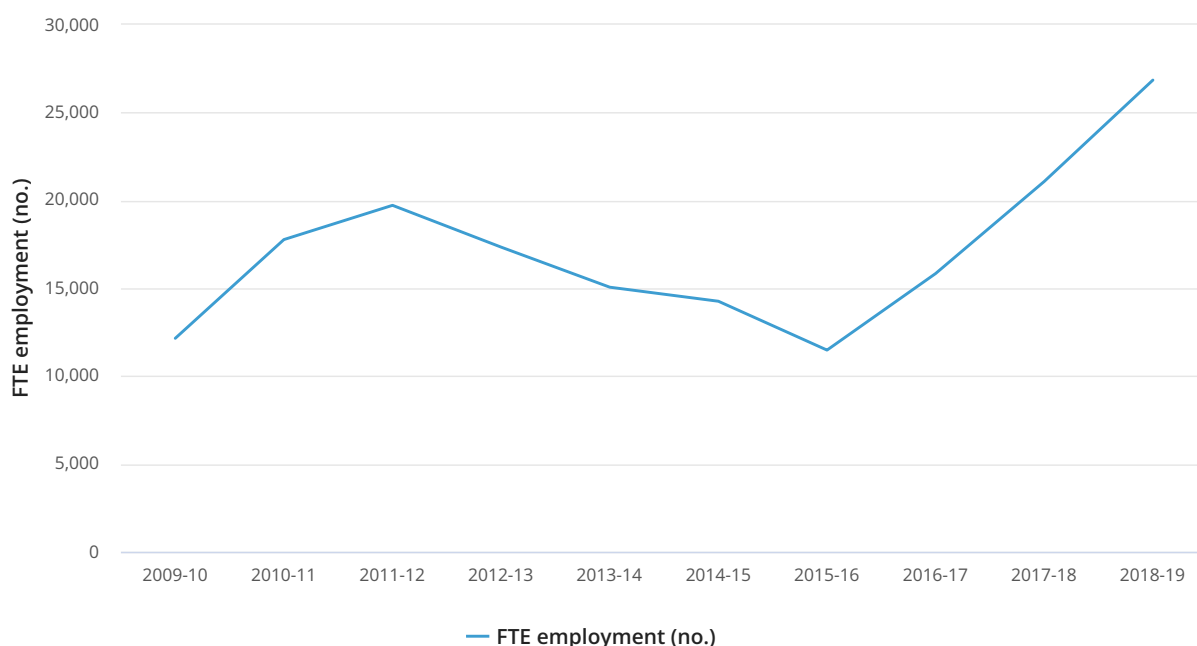
### 2018-19 overview:

- 26,850 jobs
- 27% increase from 2017-18
- 120% increase over 10 years

Annual direct FTE employment in renewable energy activities in Australia was estimated at 26,850 jobs in 2018-19.

As Figure 1 shows, this was an increase of 5,770 jobs in FTE employment (27%) from the previous year (2017-18) and represents the highest level of FTE employment in renewable energy activities since 2011-12.

**Figure 1 - Annual direct FTE employment in renewable energy activities in Australia, 2009-10 to 2018-19**



The increase of FTE employment in renewable energy activities between 2017-18 and 2018-19 was driven by an increase in construction activity for roof-top solar photovoltaic (PV) systems (2,880 additional FTE jobs), large scale solar PV systems (1,600 additional FTE jobs) and wind farms (1,220 additional FTE jobs).

Solar energy accounted for over 75% of this increase and the top three renewable energy types (roof-top solar, large scale solar and wind) contributed 99% of the increase in FTE employment in renewable energy. The only renewable energy type to record a fall in employment between 2017-18 and 2018-19 was biomass (down by 70 FTE jobs, or 4%).

### **Types of renewable energy:**

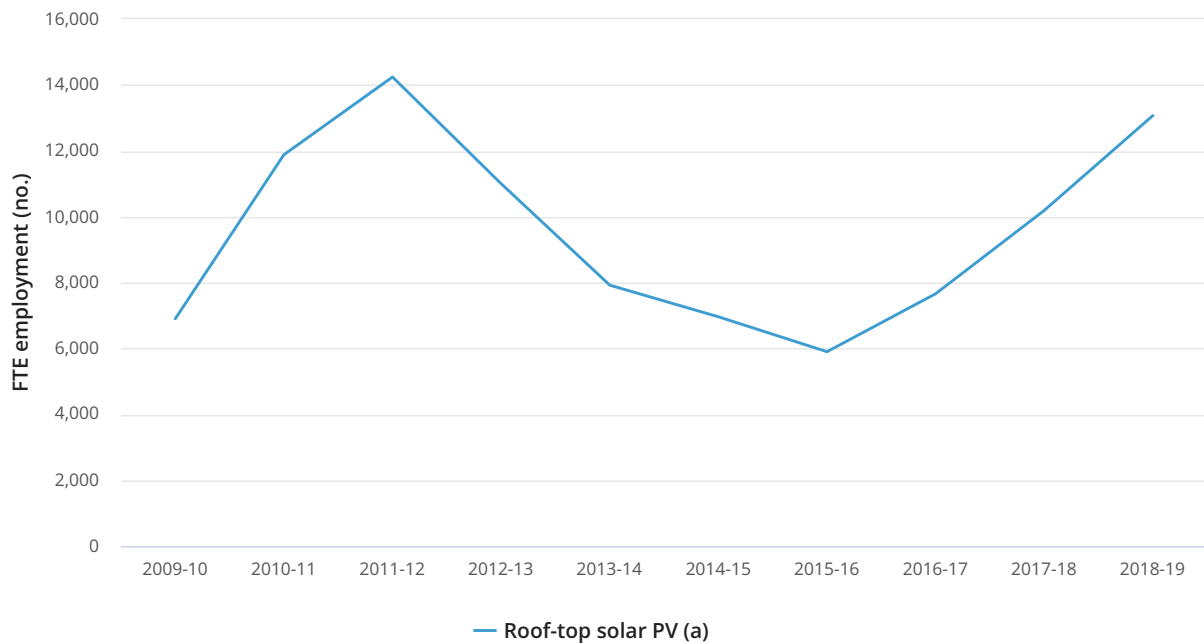
1. Roof-top solar PV systems (a) (13,070 jobs)

2. Solar PV large (4,740 jobs)
3. Wind (3,240 jobs)
4. Hydro (3,060 jobs)
5. Biomass (1,580 jobs)
6. Govt/NPI (1,120 jobs)
7. Geothermal (40 jobs)

Footnote(s): (a) Roof-top solar includes solar hot water systems and small scale batteries.

Roof-top solar PV systems remained the largest FTE employer among renewable energy types, comprising 13,070 FTE jobs or nearly 50% of total FTE employment related to renewable energy in 2018-19. While employment in this category has fluctuated over time, it has been the largest single contributor in every year of the published time series. It peaked in 2011-12, when employment in roof-top solar PV made up 72% of total direct FTE employment in renewable energy activities, but the share of renewable energy jobs has declined each year since.

Figure 2 - Annual direct FTE employment in roof-top solar activities in Australia (a), 2009-10 to 2018-19



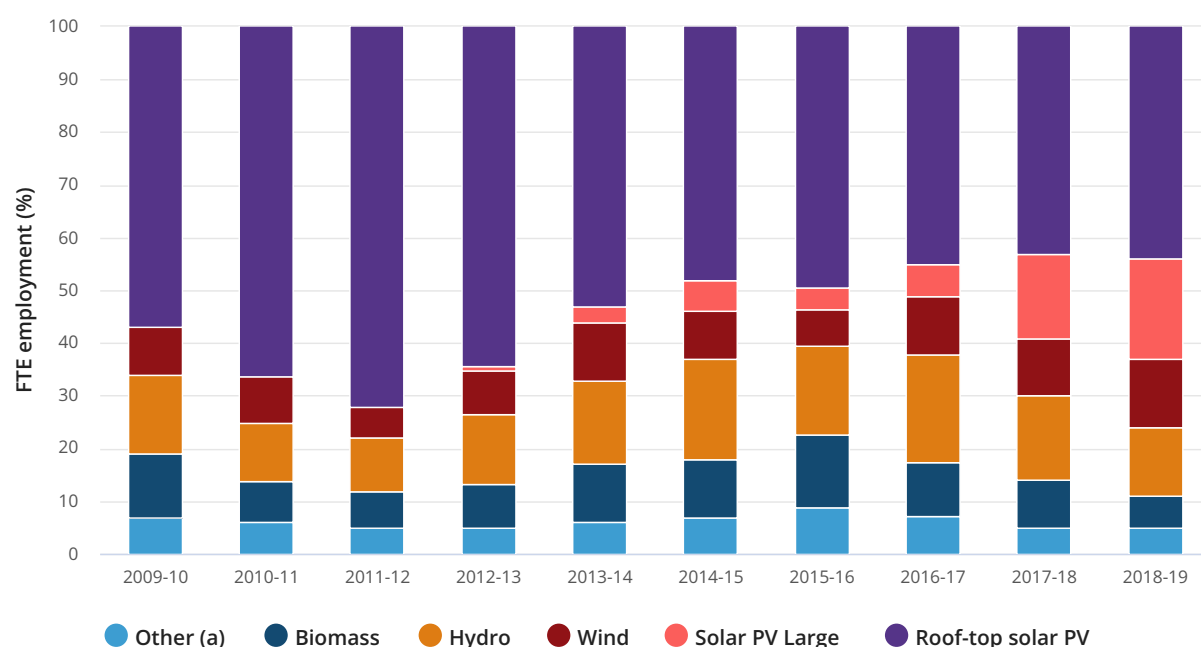
a. Roof-top solar includes solar hot water systems and small scale batteries.

Solar PV large (large scale solar) was the second largest contributor to FTE employment related to renewable energy activities (18% of total) after contributing less than 1% in each year between 2009-10 and 2012-13. It experienced the second largest increase in FTE employment of any renewable energy type, by over 50% between 2017-18 and 2018-19, increasing from 3,140 FTE jobs to 4,740 FTE jobs. This is despite an increase in the efficiency of developing large scale solar PV systems.

Wind energy reported the highest growth in FTE employment of 60% between 2017-18 and 2018-19 (2,020 FTE jobs to 3,240 FTE jobs) and more than doubled since 2016-17. This has been driven by the increase in wind farm projects in Victoria.

Hydro electricity (3,060 FTE jobs) and biomass (1,580 FTE jobs) also made large contributions to total FTE employment in renewable energy activities in 2018-19.

Figure 3 - Proportion of annual direct FTE employment by type of



a. Roof-top solar includes solar hot water systems and small scale batteries;

b. Other includes hydro plus government and non-profit institutions.

In Australia, hydro and biomass represent mature renewable energy sources, with much of their supporting infrastructure having been in place for some time. Employment in these areas is therefore relatively stable over the reported time series. In contrast, recent employment recorded against wind and solar energy, both roof-top solar and large scale solar, relates predominately to construction activity and is therefore more volatile, reflecting the fluctuation of energy infrastructure capital formation.

### States and territories:

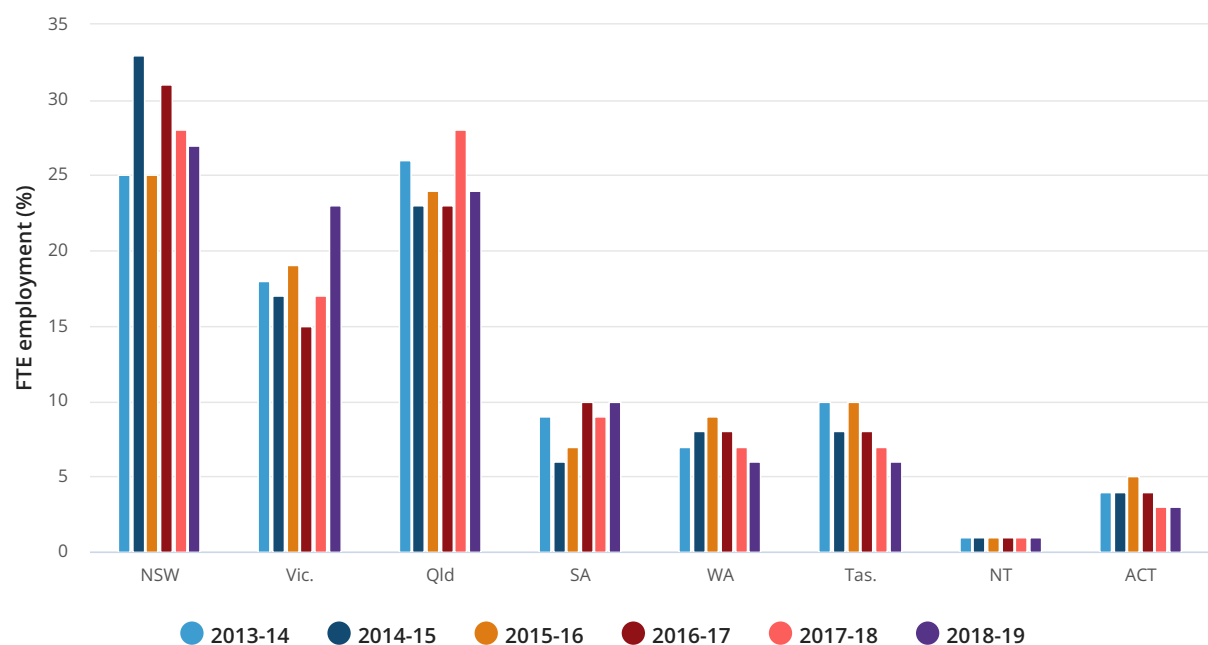
1. New South Wales (7,750 jobs)
2. Queensland (6,330 jobs)
3. Victoria (6,090 jobs)
4. South Australia (2,560 jobs)

5. Western Australia (1,690 jobs)
6. Tasmania (1,560 jobs)
7. Australian Capital Territory (680 jobs)
8. Northern Territory (190 jobs)

All states reported an increase in FTE employment related to renewable energy activities between 2017-18 and 2018-19. Victoria reported the largest increase (up by 2,540 FTE jobs or over 70%), with New South Wales and South Australia reporting an increase of 1,540 (up 25%) and 750 (up 41%) jobs respectively. In New South Wales and Victoria this increase was mainly driven by the construction of roof-top solar PV.

Together New South Wales, Victoria and Queensland accounted for 75% of all FTE employment in renewable energy activities in Australia in 2018-19.

**Figure 4 - Proportion of annual direct FTE employment by state and territory, 2013-14 to 2018-19**



**Penetration of roof-top solar PV across Australia:**

- 27% of suitable private dwellings with roof-top solar PV
- Over 2.2 million roof-top solar PV systems

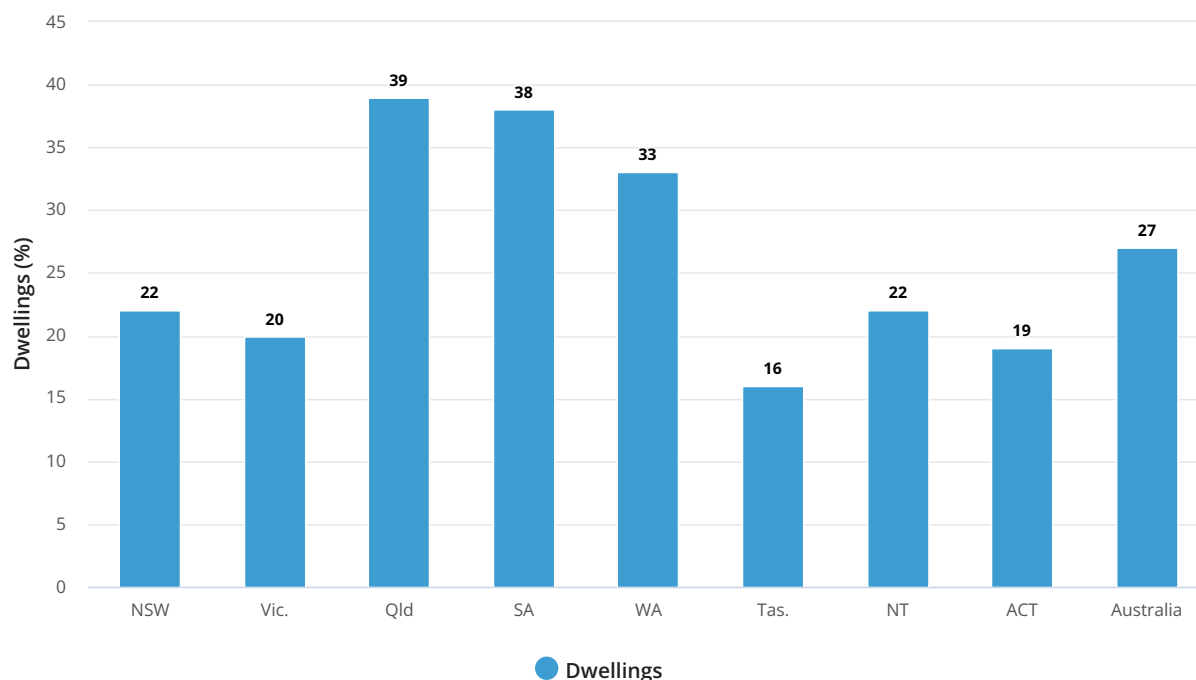
Levels of FTE employment supporting the installation of roof-top solar PV systems are influenced by various government policies, including taxes, subsidies, pricing policies and renewable energy targets.

In Australia, 27% of suitable private dwellings were equipped with a roof-top solar PV system as at December 2019.

Data from the Clean Energy Regulator (2020) reports that there were cumulatively over 2.2 million roof-top solar PV systems installed in Australia at the end of December 2019. This can be compared to the 2016 ABS Census of Population and Housing to estimate coverage of suitable dwellings with roof-top solar PV systems in Australia.

A suitable dwelling is defined as a separate house or a semi-detached row or terrace house. Not all types of dwelling structures are suitable for hosting roof-top solar PV systems, for example, caravans, tents and many units and apartments. Some detached houses, terrace houses and townhouses have the structural capacity to host a roof-top solar PV system but are impractical for other reasons, such as a poor solar aspect. It is not possible to separately identify and exclude such dwellings from the total housing stock.

Figure 5 - Percentage of suitable dwellings with roof-top solar PV (a), 2017-18



a. Roof-top solar includes solar hot water systems and small scale batteries.

The penetration of roof-top solar PV varies across states and territories. Queensland (39%), South Australia (38%) and Western Australia (33%) reported the highest proportion of suitable private dwellings with a roof-top solar PV system. Every state and territory in Australia recorded an increase in roof-top solar PV penetration between 2017-18 and 2018-19.

## Introduction

The amount of energy derived from renewable energy sources in Australia continues to grow. The Australian Bureau of Statistics (ABS) [Energy Account, Australia 2017-18](https://www.abs.gov.au/ausstats/abs@.nsf/mf/4604.0) (<https://www.abs.gov.au/ausstats/abs@.nsf/mf/4604.0>) (cat. no. 4604.0) released in December 2019 reports that 383 petajoules (PJ) of energy was supplied from renewable sources in 2017-18, up from (up from 283PJ in 2009-10). While the proportion of energy supplied from



renewable sources in Australia remains small (1.6% in 2017-18), the proportion of electricity generated from renewable sources is significant and growing. The Department of the Environment and Energy (DoEE) in its [Australian Energy Update 2019](https://www.energy.gov.au/publications/australian-energy-update-2019) (<https://www.energy.gov.au/publications/australian-energy-update-2019>) reports that 17% of Australia's electricity was generated from renewable sources in 2017-18. There is considerable interest in renewable energy including interest in the amount of employment associated with renewable energy activities. This publication contains estimates of annual direct full time equivalent (FTE) employment in renewable energy activities for the years 2009-10 to 2018-19 for Australia and its states and territories. This project was funded by the [Australian Renewable Energy Agency \(ARENA\)](https://arena.gov.au/) (<https://arena.gov.au/>).

An important role of this publication is to establish guiding principles for understanding employment in renewable energy. These guidelines have been established in large part by following general accounting principles embodied in relevant international statistical standards: the 2008 edition of the [System of National Accounts \(2008 SNA\)](https://unstats.un.org/unsd/nationalaccount/sna2008.asp) (<https://unstats.un.org/unsd/nationalaccount/sna2008.asp>) and the 2012 Central Framework of the [System of Environmental-Economic Accounting \(SEEA-CF\)](https://seea.un.org/content/seea-central-framework) (<https://seea.un.org/content/seea-central-framework>). Estimates are also consistent with [guidelines concerning a statistical definition of employment in the environmental sector](https://www.ilo.org/global/statistics-and-databases/standards-and-guidelines/guidelines-adopted-by-international-conferences-of-labour-statisticians/WCMS_230736/lang--en/index.htm) ([https://www.ilo.org/global/statistics-and-databases/standards-and-guidelines/guidelines-adopted-by-international-conferences-of-labour-statisticians/WCMS\\_230736/lang--en/index.htm](https://www.ilo.org/global/statistics-and-databases/standards-and-guidelines/guidelines-adopted-by-international-conferences-of-labour-statisticians/WCMS_230736/lang--en/index.htm)) produced by the International Labour Organisation. Appendix 1 of the guidelines describes how relevant international statistical standards have been interpreted and used to develop a notion of employment in renewable energy activities.

The International Renewable Energy Agency (IRENA) in [Renewable Energy and Jobs - Annual Review 2019](https://www.irena.org/publications/2019/Jun/Renewable-Energy-and-Jobs-Annual-Review-2019) (<https://www.irena.org/publications/2019/Jun/Renewable-Energy-and-Jobs-Annual-Review-2019>) publishes estimates of employment in renewable energy at global, regional and national levels. IRENA acknowledges the difficulties of drawing together disparate data on employment in renewable energy activities but does not offer a precise definition of renewable energy employment. Similarly, national estimates of employment in renewable energy jobs, both official and unofficial, typically provide only limited detail on those activities deemed to be 'renewable energy' activities. This publication systematically identifies, for each renewable energy type, the main activities considered to be in scope of employment in renewable energy activities. These activities typically range from manufacturing of equipment specific to renewable energy; installation of renewable energy infrastructure; and the operation and maintenance of this infrastructure. This publication includes employment in government agencies and non-profit institutions (NPIs) where this employment is predominantly motivated by support for renewable energy.

Appropriate estimation methodologies are required to support estimates of employment in renewable energy activities. National statistical agencies do not typically collect information on renewable energy employment directly from survey respondents since the burden on survey respondents and on statistical agencies can be considerable, especially given the difficulties in identifying an appropriate list of employing businesses. The ABS has estimated employment in renewable energy activities by using two techniques: firstly, by accessing information made publicly available on websites by renewable energy providers and other bodies; and secondly by utilising employment factors. The latter technique uses information on the amount of energy produced by renewable energy installations, numbers of installations and specific employment factors. Employment factors indicate the number of annual direct FTE jobs created per physical unit of choice. The technique is described more fully on the methodology page.

The estimates contained in this publication represent the outcome of development work requiring the use of assumptions and synthetic estimates for some data components, and are considered experimental. The ABS has sought and received valuable input from the statistical user community to develop the methodologies underpinning these estimates, in particular from industry experts and from relevant government agencies.

The ABS hopes that future publications will continue to benefit from the input of interested parties from industry, government, academia and the general community. As such, the ABS welcomes feedback on the estimates contained in this publication. Comments may be directed to [environment@abs.gov.au](mailto:environment@abs.gov.au) (<mailto:environment@abs.gov.au>) or in hardcopy to:

Director, Centre of Environmental and Satellite Accounts, Physical Environment Accounts  
and Statistics Branch  
Australian Bureau of Statistics  
GPO Box 9817  
Brisbane QLD 4001.

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## Changes in this issue

Changes in this issue reflect ongoing ABS research into the measurement of employment in renewable energy activities, supported by valuable feedback from industry experts and government sources. The ABS is grateful for this feedback and will continue to actively seek and use stakeholder input.

## Small scale battery installations included from 2014-15 onwards

This release includes employment activities related to the construction and operation of small scale battery-based energy storage systems, as these systems are integrally linked to renewable energy source(s). New data became available in 2020 on the installation of small scale battery, predominately for households and some small commercial applications. The first small scale battery connected to solar panels was recorded to be in 2014-15, so this publications assumes minimal (less than 10 FTE jobs) employment back to 2009-10.

These batteries represent an enabling technology in support of renewable energy and the employment required to put these batteries into operation is in scope of this publication. Battery-related employment is not separately identified in this release but is instead reported in combination with the type of renewable energy being enabled (roof-top solar power).

## Hydropower methodology update

Methodology used to estimate hydropower employment reviewed and updated in this issue. New data about employment in the hydro industry became available in 2020. Previous data in the series were revised to reflect updated numbers of FTE jobs.

## Data downloads

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Tables 1-12 annual direct FTE employment in renewable energy activities

[↓ Download XLS](#)  
[128 KB]

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## Previous catalogue number

This release previously used catalogue number 4631.0.

## Methodology

[Employment in Renewable Energy Activities, Australia methodology, 2018-19 financial year](#)